UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/732,003	12/07/2000	Rodney A. DeKoning	99-284	1605

			EXAMINER
24319	7590	06/14/2004	THOMAS, SHANE M

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ART UNIT	PAPER NUMBER
2186	10

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

	Application No.	Applicant(s)
Office Action Summary	09/732,003	DEKONING ET AL.
	Examiner	**Art Unit**	
	Shane M Thomas	2186	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) FROM
THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____ .

2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-15* is/are pending in the application.

    4a) Of the above claim(s) *3,4,9,10 and 15* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,2,5-8 and 11-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *08 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____ .

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1)☒ Notice of References Cited (PTO-892)

2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3)☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date _____ .

4)☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____ .

5)☐ Notice of Informal Patent Application (PTO-152)

6)☐ Other: _____ .

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in
> section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are
> such that the subject matter as a whole would have been obvious at the time the invention was made to a person
> having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the
> manner in which the invention was made.

The Examiner has respectfully withdrawn the previous rejections of claims 1, 2, 5-7, and

13 under §103(a) as unpatentable over Nguyen et al. (U.S. Patent Application Publication No.

US 2002/0004883) and claims 3, 4, 9, 10, 14, and 15, also under §103(a), as being unpatentable

over Ito et al. (U.S. Patent No. 6,408,359) in view of D'Errico (U.S. Patent No. 6,314,503).

These rejections were purported as being --silent and apparently maintained-- according to page

8 of the Applicant's amendment filed 21 April 2004 (Paper No. 7). To clear the record, the

Examiner had withdrawn the aforementioned rejections and had thus rejected claims 1,2,5-8, and

11-13 under §103(a) as being unpatentable over Otterness et al. (U.S. Patent No. 6,654,831) in

view of Nguyen, claims 3 and 4 under §103(a) as being unpatentable over Otterness in view of

Nguyen in further view of Allen (U.S. Patent No. 5,151,990), claims 9 and 14 under §103(a) as

being unpatentable over Otterness in view of Nguyen in further view of Burgess (U.S. Patent No.

5,796,633), and claims 10 and 15 under §103(a) as being unpatentable over Otterness in view of

Nguyen, in further view of Burgess in further view of Komachiya et al. (U.S. Patent No.

6,571,314). Further, the Examiner had rejected claims 1, 2, 5-8, and 11-13, under §103(a) as

being unpatentable over Ito et al. (U.S. Patent No. 6,408,359) in view of Otterness and claims

3,4,9,10,14, and 15, under §103(a) over Ito in view of Otterness in further view of D'Errico (U.S. Patent No. 6,654,831).

As per Applicant's amendment filed 24 April 2004 (Paper No. 7), the Examiner respectfully withdraws the rejections of claims 1,2,5-8 and 11-13 under §103(a) as being unpatentable over Otterness in view of Nguyen as well as the rejections under §103(a) over Ito in view of Otterness, claims 3 and 4 under §103(a) as being unpatentable over Otterness in view of Nguyen in further view of Allen, claims 9 and 14 under §103(a) as being unpatentable over Otterness in view of Nguyen in further view of Burgess, claims 10 and 15 under §103(a) as being unpatentable over Otterness in view of Nguyen in further view of Burgess in further view of Komachiya and claims 3,4,9,10,14, and 15, under §103(a) over Ito in view of Otterness in further view of D'Errico.

Amended **claims 1, 2, 5-8, and 11-14** are rejected under 35 U.S.C. 103(a) as being unpatentable over Ito et al. (U.S. Patent No. 6,408,359) in view of Otterness et al. (U.S. Patent No. 6,654,831) in further view of D'Errico (U.S. Patent No. 6,314,503).

(NEW) As per **claims 1, 8, and 14** the examiner is referring to a --consolidated storage array-- as the system of figure 1 combined with the --storage arrays--, the storage arrays comprising storage devices 1807a-1807c with controller 1806a and storage devices 1807d-1807f, respectively, of figure 5. Virtual data volumes (or --logical data volumes--) are distributed equally to each storage array and also to each storage device within the array (column 3, lines 40-53). The examiner is referring to a --host device-- as the external device, which can run software applications for a Video-On-Demand service (column1, lines 21-24), which sends the

file creating request to the Destination Determining Part 1803 (figure 1) of the consolidated

storage array. The external device sends a --file-- (or virtual data volume) request that includes

information specifying the number (size) of storage locations of the virtual data volume to the

Destination Determination Part (1803 of figure 1) of the consolidated storage array (column 3,

lines 43-49). The examiner will refer to this information as the --performance requirement-- of

the virtual data volume. As mentioned above, Ito states that the virtual data volume is spread

equally throughout the storage arrays and storage devices so that the consolidated storage array

can respond to a read request at a high speed, since access requests do not concentrate on specific

storage devices nor specific storage array. Therefore, the performance capability (bandwidth

and/or physical volume size) of a single array is less than that of the collective storage arrays

comprising the consolidated storage array. Further, it can then been seen that the virtual data

volumes' performance requirements exceed the performance capabilities of a single storage array

because they span across the storage arrays in the system of Ito.

(Previous Action) Ito lacks the ability to have a controller 1806 (figure 5) resume the

responsibilities of writing and reading data of another controller if that controller fails or

malfunctions. Otterness shows a system in figure 5 that equips redundant controllers 302 to a

plurality of storage devices (data spans 358), and each controller being able to access each other

controller's plurality of storage devices upon failure of a controller (column 8, lines 22-29).

Therefore it would have been obvious to one having ordinary skill in the art at the time the

invention was made to have combined the consolidated storage array system as taught by Ito

with the teaching of multiple redundant --master-- controllers as taught by Otterness in order to

have been able to have been able to re-direct an I/O request directed to a failed controller to an

active controller (column 8, lines 28-29) and further to have been able to access a failed

controller's storage devices (data span 358). Such a configuration would have allowed the

storage array (combination of controller 1806b with storage devices 1807d-f, for example) of the

consolidated storage array of Ito (figure 5) to have accessed the storage devices 1807a-c when a

failure or malfunctions is detected with controller 1806a. Such a configuration would have

increased data reliability and to have allowed any controller to fail in the consolidated storage

array without data loss (column 8, lines 36-38 of Otterness).

(Previous Action) The Examiner is considering the combination of a controller 302 with

its respective disk span 358 as being the equivalent to the storage array structure of Ito. Figure 6

of Otterness shows the design of controllers 302 of figure 5. As can be seen, Otterness includes

the data management software portions of figure 1 of Ito (elements 1801-1803) in Otterness'

controller 302 - figure 6 (elements included in RAM memory 332). Further, Otterness includes

an I/O interface (1808, figure 5 of Otterness) in each controller 302 (element 310 of figure 6 of

Otterness). Thus it could have been seen with the teachings of Otterness that each --storage

array-- of modified Ito would have had included the data management elements of figure 1 of Ito

and the I/O interface 1808 of Ito's figure 5.

(Previous Action) Regarding amended claim 1, lines 8-9, and amended claim 8, line 14,

Otterness states in column 8, lines 9-40, that any active controller (of a --storage array--) of

figure 5 can be a --primary device-- and can transfer data, thus the modified controllers 1806 of

Ito could have performed the same with the applied teaching by Otterness.

(Previous Action) Regarding amended claim 1, line 27, as discussed above, the Examiner

is considering the combination of the modified controller of Ito 1806 (which with the teaching of

Otterness includes I/O interface 1808 and data management software (1801-1803 of figure 1 of

Ito)) and the storage devices 1807 to be a --storage array--; thus, the method of amended claim 1,

as taught by Ito, could have been performed by the controller 1806 of an active (primary) device

of modified Ito.

(Previous Action) Regarding amended claim 1, lines 28-29, and amended claim 8, lines

33-34, Otterness states in column 8, lines 39-41, that any --storage array-- can become an active

[primary] device if a [primary] device fails and take over for the failed device.

(Previous Action) Modified Ito's system indirectly would have analyzed the storage

arrays for their performance capabilities (physical volume size, or remaining volume size in this

instance) by keeping track of empty storage locations in the Empty Area Managing Part (1802 in

figure 1). This part manages the empty --blocks-- (storage locations not containing data

associated with a virtual data volume) of each of the storage devices using an address of each

empty storage location as well as first and second identifiers, which identify a specific storage

device and specific storage array, respectively (refer to column 3, lines 19-39).

(Previous Action) The Destination Determination Part (1803 of figure 1) selects and

configures locations from each of the storage devices of each storage array by utilizing the

information provided by the Empty Area Managing Part and the Configuration Managing Part

(1801 of figure 1), which manages the number of storage devices and respective identifying

information of the system. The flow chart of figure 6 shows a method used to select and

configure empty storage locations by selecting a set number of locations per loop cycle (steps

S2305-S2307), allocating them for the virtual data volume (step S2308), comparing the number

of locations allocated to the number requested in the performance requirement for the volume

sent by the host (step S2309), and selecting and configuring more locations if the number

allocated is less than the number requested. Thus the method of figure 6 shows how the

performance requirements (size of volume requested by the host) are met by the consolidated

storage area system in figure 5 (see column 3, lines 19-39).

(Previous Action) Volume information would have been created and managed by the

system in the address position file such like element 2401 of figure 7. Each virtual data volume

has an address position file associated with it (column 11, lines 11-17). It is inherent that once

the virtual data volume is created among the storage arrays and the storage devices that the

applications running on a host device, which sent the volume request to the system of Ito, would

have used the allocated storage locations to store and retrieve data. Address position file

(volume information) is sent from the consolidated storage array to the host device. The I/O

control unit 1808 distributes the data inputted from the external device of the host to the storage

device control units (1806a and 1806b). These control units then write the data to the allocated

storage locations (refer to column 8, lines 54-61). As discussed above, the Examiner is

considering the I/O control unit 1808 (interface) and the storage device control units to be

comprised in the controllers 302 of the storage arrays as shown in figure 5 of Otterness.

(Previous Action) Regarding **claim 8**, the Configuration Managing Part 1801 of figure 1

stores the number of storage devices and respective identifying information, and as has been

mentioned above, is being considered by the Examiner to be integrated into the controllers of the

storage arrays, as taught by Otterness in figure 6. Thus it could have been seen that a --CSA

primary device-- (one of the storage arrays, is connected to *all other* the storage arrays as shown

in figure 5 of Otterness. Finally, the examiner refers to the collection of the host, consolidated

storage array, and the CSA primary device as a --storage area network--.

(NEW) Regarding **claim 1, lines 21-26, claim 8, lines 27-32, and claim 14, lines 7-14,**

Ito states that although data is distributed to all storage devices in each storage array of the

embodiment described in the above rejections, an alternate embodiment could have data

distributed to specific storage devices in each storage array (column 11, lines 65-67). Ito does

not disclose in either embodiment a method for monitoring the data transfer performance, which

the examiner is referring to as a --performance capability--, of the storage arrays in order to

determine whether the storage arrays are performing within a predetermined range of the

maximum --performance capability-- of each array. Additionally, Ito does not disclose a method

to alleviate the condition of an array performing within its predetermined maximum capability

(or maximum data transfer) by adjusting [at least a portion] of the data between the logical

volume of the over-performing (--first--) storage array and another (--second--) storage array.

(Previous Action) D'Errico teaches in column 3, lines 49-63, that in a system with

multiple storage devices a performance condition can be detected (hence monitored) and

alleviated by the re-distribution of system data between the multiple storage devices.

Specifically, D'Errico teaches that in a system with a plurality of storage devices, a method

comprises the steps of: (A) detecting a segment in the storage system that is accessed frequently

and sequentially (a virtual volume) and is stored on one of the plurality of storage devices and

(B) in response to step (A), splitting the large data segment into at least two smaller data

segments that can be accessed in parallel from at least two of the plurality of storage devices,

thereby improving the performance of the overall system.

(NEW) D'Errico further states in column 8, lines 47-51, that the detection (monitoring)

and splitting (adjustment of a portion [hotspot] of a logical volume) can be performed by in the

disk controllers 7a-7b and storage bus directors 9 (figure 1). Because the primary (master)

controller of the modified system of Ito directs the distribution of data and controls what the

other [slave] controllers do with the data (column 4, lines 57-62, of Otterness), it would have

been seen by one having ordinary skill in the art that the primary controller of modified Ito

would have controlled the monitoring and adjusting (of the logical volume hot spot) as taught by

D'Errico since D'Errico teaches that he monitoring and adjusting occurs in the disk controllers.

(NEW) Therefore, it would have been obvious to one of ordinary skill in the art at the

time the invention was made to incorporate the teaching of D'Errico to the data storage system of

Ito, in order to alleviate the burden of an array that is performing within its predetermined

maximum performance capability by reallocating the virtual data volume that is causing the

increase in the data transfer performance of the array, by migrating a portion of the virtual data

volume to at least a second storage array. Specifically D'Errico's method should have been

incorporated into the consolidated storage array's --storage arrays-- (combination of modified

Ito's controllers 1806 with their respective storage devices 1807) since it performs all of the

managing procedures of the storage arrays and virtual data volumes, as has been described above

(and taught by D'Errico in column 6, lines 47-51). The teaching of D'Errico would have

allowed the modified system of Ito to migrate frequently accessed data (data with a detected high

transfer performance), by *adjusting* a portion of the logical volume (hotspot), and have

distributed it among other storage arrays and devices (column 6, line 60 - column 7, line 15 of

D'Errico). Thus, an increase in the amount of data that could have been accessed by an

application using the data storage system of modified Ito in the same amount of time would have

been achieved. Further, the splitting of the virtual data volume among the storage arrays and

devices would be transparent to the host (and therefore the application running on the host). This

aspect is advantageous since the method of D'Errico could have been performed automatically

without requiring modification to the application running on the host device, and without

requiring manual intervention [by the a system operator] (refer to column 6, lines 60-67 thru

column 7, line 15). Therefore, it could have been seen that the teaching of D'Errico would have

reduced the burden of the data system by increasing the rate at which data could have been

accessed, thus improving system performance by splitting a virtual data volume among storage

arrays and storage drives while the division would have remained transparent to the host that

would have utilized the data system of Ito.

(Previous Action) Regarding amended **claim 14**, the rejections of lines 15-18, follow the

rejection of amended claim 1, lines 27-29.

(Previous rejection) As per **claim 2**, as has been shown in the rejection for claims 1 and 8

above of Ito, an external device (of a host) issues a file (or virtual volume) create command to

the Destination Determining Part of the --consolidated storage array--. Once the volume has

been allocated, the CSA sends the address position file (volume information) to the host device

to enable the applications running on the host to utilize the allocated volume to store and retrieve

data.

(Previous rejection) As per **claims 5 and 11**, as has been shown in the rejection for

claims 1 and 8 above of modified Ito, the external system specifies the size requirement for the

virtual data volume by the number of storage blocks (locations) it needs in order to sufficiently

store its data (see column 5, lines 43-49). Further, as has been stated, the examiner is referring to

the --size-- of the volume to be the --performance requirement-- of the volume.

(Previous rejection) Regarding **claim 11**, Ito is referring to a user as something that is

utilizing the storage device management system to access (store/retrieve) data. In one example,

the system of modified Ito is being used in a Video-On-Demand system as a video server. In this

case, it could have been seen that the --user-- could be a --client-- of the server and is requesting

a video object and would therefore read data from modified Ito's system. More indirectly, the

Examiner is interpreting a user to be the person controlling the --client-- wishing to access the --

videos-- contained on the system of modified Ito.

(Previous rejection) As per **claim 6**, as has been detailed in the rejection for claims 1 and

8 above, the Destination Determining Part of the --consolidated storage array-- allocates storage

locations within each storage device of each storage array for each request for a virtual data

volume. The software application running on the external device of the host sends data through

the external device and supplies it to the I/O control unit (1808 of figure 5) which then sends the

data, using the address position file (volume information) received from the consolidated storage

array, to the respective storage device control units (1806a and 1806b). The examiner is

referring to this procedure as --striping-- data from the host device since the data is not written a

specific storage device nor specific storage array.

(Previous rejection) As per claim **7 and 12**, the same definition of striping as defined in

the rejection for claim 6 is herein used for claim 7 and 12's rejection. Further, a --striping

definition-- in incorporated into the address position file (volume information) that is created and

sent from the Destination Determining Part (1803 of figure 1) of the consolidated storage array.

This --striping definition-- supplies the host's I/O control unit 1808 with the address of the

allocated storage locations of the virtual storage array so it can begin sending the data received

from the host's external device to the respective storage control units 1806, which write the data

to the storage devices 1807.

As per **claim 13, lines 1-6**, the same rejection for amended claim 1 is applied.

(Previous Action) Regarding **claim 13, lines 7-9 and 12-13,** as has been shown in the

rejection for claims 1 and 8 above of Ito, an external device (of a host) issues a file (or virtual

volume) create command to the Destination Determining Part of the

--consolidated storage array--. Once the volume has been allocated, the CSA sends the address

position file (volume information) to the host device to enable the applications running on the

host to utilize the allocated volume to store and retrieve data.

(Previous Action) Regarding **claim 13, lines 10-11,** the rejection follows the rejection for

amended claim 1, lines 8-9.

(Previous Action) Regarding **claim 13, lines 13-18,** as has been detailed in the rejection

for claims 1 and 8 above, the Destination Determining Part of the --consolidated storage array--

allocates storage locations within each storage device of each storage array for each request for a

virtual data volume. The software application running on the external device of the host sends

data through the external device and supplies it to the I/O control unit (1808 of figure 5) which

then sends the data, using the address position file (volume information) received from the

consolidated storage array, to the respective storage device control units (1806a and 1806b). The

examiner is referring to this procedure as --striping-- data from the host device since the data is

not written a specific storage device nor specific storage array.

(Previous rejection) Further, a --striping definition-- in incorporated into the address

position file (volume information) that is created and sent from the Destination Determining Part

(1803 of figure 1) of the consolidated storage array. This --striping definition-- supplies the

host's I/O control unit 1808 with the address of the allocated storage locations of the virtual

storage array so it can begin sending the data received from the host's external device to the

respective storage control units 1806, which write the data to the storage devices 1807.

(NEW) Regarding **claim 13, lines 19-23,** the rejection follows the rejection of claim 1,

lines 21-26.

(Previous Action) Regarding **claim 13, lines 24-27,** the rejection follows the rejection for

amended claim 1, lines 24-27.

Response to Amendment

In response to Applicant's amendment filed 21 April 2004, the Examiner has cancelled

the previous rejections under §103(a) as stated above, and has rejected claims 1,2,5-8, and 11-14

under §103(a) as being unpatentable over Ito et al. (U.S. Patent No. 6,408,359) in view of

Otterness et al. (U.S. Patent No. 6,654,831) in further view of D'Errico (U.S. Patent No.

6,314,503). The Examiner has further cited column 8, lines 47-51, of D'Errico to teach the

added limitations to the claims.

Claims 3,4,9,10, and 15 have been cancelled.

Response to Arguments

Applicant's arguments with respect to claims 1,8,13, and 14 on page 10 of the

amendment (paper #7), filed 21 April 2004, have been considered but are moot in view of the

new ground(s) of rejection. Applicant's amendments to claims 1,8,13, and 14 have changed the

scope of claims. As noted in the Advisory Action (Paper #8), mailed 29 April 2004), the

Examiner considers the terms --migrating-- and --adjusting-- to differ in terms of the art.

Therefore, the scope of the claims has changed.

Conclusion

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Shane M Thomas whose telephone number is (703) 605-0725.

The examiner can normally be reached on M-F 8:30 - 5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's

supervisor, Matt M Kim can be reached on (703) 305-3821. The fax phone number for the

organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent

Application Information Retrieval (PAIR) system. Status information for published applications

may be obtained from either Private PAIR or Public PAIR. Status information for unpublished

applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR

system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Shane M. Thomas
June 7, 2004

MATTHEW KIM
SUPERVISORY PATENT EXAMINER
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